NICE^3 Technical Periodic Report #4

September 2001

1. Title / State / Company

Precision Irrigation Technologies for the Agricultural Industry
Colorado Office of Energy Management and Conservation
Colorado Corn Administrative Committee

2. Periodic Activity Summary - In a narrative format, briefly describe the technical progress for the period.

The AccuPulse system was used twice at the Yuma site to apply herbicide and once at the Wiggins site to apply fungicide. Three field tests were conducted at both the Wiggins and Yuma sites to measure the uniformity of coverage and compare with uniformities measured from conventional ground and aerial applicators. Ongoing technical progress for the period includes weekly field checks with intensive scouting, water sampling, aerial photography, well tests, soil sampling, Gyp Block installation and weekly evaluation. Design and installation of a steel structure in the lab for testing a variable rate AccuPulse system is nearly complete. Once the management zones are determined and the AccuPulse is set up for variable rate, we plan to treat the zones differently during next year's growing season.

3. Milestone Table

a) Describe technical progress for the period, with ongoing activities and discuss the actions taken to meet the milestone deadlines.

Spray uniformity tests were conducted by USDA-AARS at the Wiggins site on June 22 and in August and at the Yuma site on July 6. On June 22, tests were made on both the AccuPulse and ground rig sprayer using water only. On July 6, Dual, a corn herbicide, was applied only with AccuPulse. In August, tests were made on both AccuPulse and aerial applications using a combination of several fungicides for onions. For each test, a 5 x 10 grid of water sensitive cards (3" x 2") were placed on wood blocks at a spacing of 5 ft at two radial distances along the sprinkler mainline. An additional 5 x 5 grid with a spacing of 1.25 ft was also set up within at least one of the larger grids to capture the small-scale variability. Analysis of the cards is ongoing. Approximately half of the 800 water sensitive cards that were collected have been scanned at a density of 300 dpi. GIS software is being used to quantify the percentage of surface area covered by the spray solution. Representative cards have been analyzed to test the analysis process, but final results are not complete yet.

Weekly field checks were made by Servi-Tech from 3/30/01 - 9/7/01 at the Wiggins site and 5/18/01 - 9/7/01 at the Yuma site. These checks involved intensive scouting of earlier determined management zones to assess plant growth, weed, insect, and disease infestations as well as evaluate the use of the AccuPulse system. Aerial photos were also taken and reviewed to assess

plant health and fine tune management zones. Two water samples were pulled at random at each site to analyze irrigation water quality and nutrient levels.

Soil moisture blocks (Gyp Blocks) were installed by Y-W Well Testing at each site on May 9th. The Gyp Blocks were read weekly and a computer model of water usage has been made. Soil testing was completed, and wells at each site were tested several times for overall efficiencies.

The steel structure for suspending a 7 tower AccuPulse system in the USDA-AARS lab has been designed and fabricated. All of the system hardware has been received from Valmont and the flow rate sensors and pressure transducers for monitoring the system have been ordered and should arrive soon. We anticipate beginning installation of the system in the lab around mid-September.

Colorado Corn Administrative Committee and Foster Communications have completed several activities relative to project promotion, including designing a logo for the project. We created a logo that reflects the project name. The design complements the AccuPulse design and may change as the project progresses. The logo appears on the web site template, which is provided below:

Web Site Template

A photo shoot was conducted in Yuma to capture the AccuPulse System in action on a project farm. We collected research on current energy usage, water usage, and chemical usage for describing the changes the new technology will make. The resulting Precision Irrigation Technology brochure is completed and in the editing/review process with partners. A copy of the draft brochure is attached to this report.

b) Provide an explanation of technical difficulties encountered while testing, installing, or operating the system.

The AccuPulse system is set up to deliver a fairly large droplet size, which is fine for most herbicides and insecticides. However, fungicides need to be applied evenly on the plant leaves and this seems to be done better with a small droplet size. At the Wiggins site, half the onion field had fungicide applied by plane the other half with the AccuPulse. The AccuPulse system at

Wiggins performed well but the pulsing interval for the inner 3 towers appears to be programmed incorrectly for the speed of the tower motors that are currently installed. The result is that the spray coverage for the inner site is about twice the coverage measured at the outer site.

Testing with the water sensitive cards generally went well, except for the testing of aerial application. Since the airplane flies early in the morning when air is generally calmest, the water sensitive pads were placed in the field when there was considerable dew and the humidity was high. In the 30 minutes between card placement and the aerial application, the high humidity did change the color of the cards some, making it much more difficult to distinguish the area covered by the spray droplets.

The plan was to take three aerial photos at each site throughout the season. The end result was that the first set of photos is the only useable set. The cameraman had technical difficulties with the second set and they are not useable. These photos have to be taken with no cloud cover. There was some cloud cover on the third set and they are not of optimum quality, but we can use them to back up the first set.

Insect infestations were very low this year so it was difficult for Servi-Tech to determine if one management zone had higher pressure then the others. We will need at least one more year of field data to design accurate management zones.

Before working with the Wiggins site this year, Y-W Well Testing had little experience with the growing of onions.

Of the few problems Quality Irrigation had maintaining the AccuPulse System this season, most were freeze damage related. There was some freeze damage on the Yuma system.

c) Explain the steps taken to resolve these difficulties.

We have talked to Valmont personnel about changing the pulse interval in the programmable logic controller to increase the pulse interval for the inner 3 towers so the coverages should be more uniform. A Valmont representative confirmed that the system could be re-nozzled to allow for a smaller droplet size. We are planning to test this system again in September or October.

We are working on modifying our image analysis procedure using the GIS software to account for the change in background color on the water sensitive paper. Even though this will be a time consuming process, we are hopeful of obtaining useful data from these images.

Quality Irrigation is installing some drain valves and modifying the winterization program to provide better protection against freezing.

Y-W Well Testing worked with Colorado State University to determine estimated water use for onions, obtain the daily evapotranspiration rate, and fine tune methods for determining actual water usage.

d) Describe any known or potential changes in milestone dates.

N/A

e) Address activities and planned accomplishments for the upcoming quarter.

As reported in report #3, Quality Irrigation installed a new lifting system at the Yuma site and it seems to work quite well. We plan to install this same lift system at Wiggins this fall.

USDA-AARS will continue installation and instrumentation of a complete variable rate AccuPulse system in the lab. We plan to begin testing by January 1, 2002. We have hired a student who intends to use some of the results as part of his Masters thesis and will begin his graduate program in January 2002.

After harvest, Servi-Tech will review the yield maps produced by the Combine/Harvester. The yield maps and aerial photos will help determine locations to pull soil samples. Once sample locations are determined, we will use the GPS unit to mark the locations where the samples are taken. From this, a fertility map will be made to tie into the management zones.

Y-W Well Testing will test the wells once more this year, conduct soil tests, and host a soil compaction study in November. We will also finish our year end computer analysis.

Foster Communications' next step for the web site is to finalize a URL and upload files. This could also be done by uploading files to a precision irrigation section on the Colorado Corn Grower's site. As the site grows, and reports become available, the web site template will change as well. The brochure will be printed, and project partners will determine if a CD ROM version of the brochure should be created. The advantage of the CD version would be the ability to make updates quickly. The Trade Show products, which include a power point presentation, backdrops, and photos, are in process and will be completed.

4. Discuss results (testing etc.) and their implications to the project. Discuss any necessary or anticipated milestone additions or deletions.

At the Yuma site, the AccuPulse system was used to make two herbicide applications: May 5th - Fultime @ 3.3 qt/acre; and June 22nd - Dual II Magnum @ .67oz/acre. The applications were compared to ground rig applications and check strips. There was definitely good control and no patterns were found or differences when compared to the ground rig.

On July 25th at the Wiggins site the system was used to make a fungicide application of Dithane, Copper, and Sulfur. Half was done with the AccuPulse System and the other half was aerial applied. Because of the technical difficulties described in 3.b. the aerial applied half seemed to perform better.

Once harvest is complete this fall, Servi-Tech will need to fine-tune management zones with the use of Yield Maps, Fertility Maps, and Aerial Photos.

Y-W Well Testing found that the Gyp Blocks have shown that they are very accurate for many different crops.

Once results from using the AccuPulse System during the first year growing season have been compiled, Foster Communications will incorporate these results into updated versions of the web site, power point presentation, and possibly a CD ROM version of the project brochure. The video will be produced after the next growing season when we will have more data in place and two full seasons to capture progress.

5. Attach publications written that relate to the project (internally or externally produced). List any planned publications or conferences to be attended related to the project for the next quarter.

Attached is ASAE paper #012164 given at the 2001 ASAE International meeting in Sacramento, CA. A presentation with this paper is to be given at the 2001 Irrigation Association Exposition in San Antonio, TX in November.

Servi-Tech's weekly field reports and water analysis reports from each location are attached, as are Y-W Well Testing's irrigation management worksheets.

Y-W Well Testing gave a presentation about the project at the Irrigation Research Farm trade show in Yuma, CO in August 2001. Y-W Well Testing will also feature the project in focus group presentations in Wiggins during the next year. We are currently planning the Ogallala Symposium for 2002 in Sterling, CO, where this project will be featured.

A draft of the brochure that will be used to promote this project is attached to the report.

6. Discuss any key personnel changes (including state, cost-share, subgrantee, and others involved).

Vern Bauer, a technician for the Southeast Pumping Association joined Dave Keeler and Devin Ridnour at Y-Well Testing in July 2001. Mr. Bauer brings 16 years of experience to our water management team.

7. Discuss any cost-sharing partner/demonstration partner changes.

N/A

8. Discuss any other topics that are relevant to the scope and progress of the project.

The technical team involved in this NICE3 project will continue to meet during the winter of 2001/2002 to further expertise and enhance collaborations.